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EXPERIMENTAL MUSICAL INSTRUMENTS

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF NEW SOUND SOURCES

ANOTHER ANNIVERSARY

EMI's last issue completed our third year of publication, and with this that you hold in your hand we move into our fourth. How are we doing? Pretty well, thank you, pretty well.

Over the last year we have continued along essentially the same editorial track laid out at the time of EMI's inception. In short, that line, by now familiar to our readers, is that we cover all manner of goings-on in the world of new and unusual acoustic and electro-acoustic musical instruments. The emphasis is on clear, practical descriptions of instruments and their acoustic systems. We also look at related ideas, tools and techniques, publications and recordings.

Yet some slight shifts in emphasis have happened over the last few years. For one, we have found that many readers value material which balances the new by providing more historical perspective or highlighting particularly interesting older instruments. These include traditional instruments of

(Continued on page 17)

IN THIS ISSUE

Anniversary Editorial	Page 1
Letters	2
A Harmonic Ensemble	4
Music For Homemade Instruments	7
More Instruments by the Baschet Brothers	13
Notices	19
Recent Articles in Other Periodicals	20

Above: Water sound sculpture by the Baschets -- see page 13.

LETTERS

REGARDING YOUR ARTICLE IN THE APRIL ISSUE on the overtone series -- you should know that contemporary tuning practice on marimba and vibraphone bars brings the first two overtones of the bar into a harmonic relationship with the fundamental. Almost universally the second partial is tuned two octaves above the first; the third is another octave and a major third higher. In this way, the lower end of the overtone series is made to imitate the overtone series of a string or a column of air. In fact, this tuning process -- which is accomplished by shaping the underside of the bar in specific ways -- was one of the great advances of mallet instrument design in the early part of this century when, as you know, they were greatly popular.

The xylophone, by the way, is commonly tuned so that the first overtone is an octave and a fifth rather than two octaves above the fundamental. The third partial is high enough here that it is often ignored -- and this accounts for some of the difference in timbre between the instruments, even between notes of the same pitch.

I might also mention that contemporary playing technique on the vibraphone and, to a lesser extent, on the marimba, sometimes takes advantage of the fact that the partials have been brought to a degree "in tune." By touching the bar in the center (antinode for the mode of vibration of the first partial, node for the mode of the second), and striking directly above the cord by which the bar is strung (node for the first, antinode for the second), a harmonic two octaves above the pitch of the bar can clearly be brought out.

Hope this helps to clarify the current situation with rectangular idiophones.

Daniel Levitan

FIRST OF ALL, I applaud your extolling the validity of inharmonic instruments. Judging from the preponderance of easy listening -- from the 16th century to "new age" -- it seems we would all do well to get out and stretch our ears a bit.

As you point out, the ear does readily accept as musical a certain amount of inharmonicity. But, it should be noted, this is primarily in nonsustaining instruments in which harmonics die out quickly.

Though "natural" harmonics may not be natural in that perfectly cylindrical pipes and infinitely flexible strings do not grow wild by the roadside, harmonics are the consequence of natural physical laws of motion. The harmonics of a thick unwound string will be sharp as a result of the added stiffness, but the harmonic motion --the whole number integral modes of vibration -- will remain the same.

I'm unfamiliar with the irregularly-shaped flutes you mention. It could be that conflicting vibrations of functionally more than one enclosed air mass causes the harmonics.

The workings of the hearing mechanism, like it or not, are harmonic in nature. A loud, pure tone (i.e., no overtones) will cause one's ear to generate audible harmonics.

Why should the ear be like this?

It seems like a natural response to the most common harmonic instrument of all -- the human voice.

The fact that we can answer a telephone and from a single "hello" ascertain not only the identity of the caller, but also their mood as well, attests to the ear's phenomenal sensitivity to harmonic structure.

The tense, strained quality one hears in a voice -- is this due to a "stretched" overtone content as a result of stiff (tensed) vocal chords?

In any case, thanks for a thought-provoking article.

Michael Meadows

APROPOS OF INHARMONIC PARTIALS, all the metal bar and tube instruments now being shown at the Sonic Arts Gallery downtown [San Diego] -- five of them are what I built -- others by Jonathan Glasier, Erv Wilson, Glen Prior et al -- have inharmonic components. So your article is very timely.

Tuning forks, even, have them but usually a good tuning fork's upper partials die away quickly. Quartz crystals as used for frequency control in radio transmitters, color TV sets, and computers as well as digital watches, follow the laws of bars and plates just as you said in your article: they too have overtones which sometimes are used in electronic circuits and which are inharmonic. All this is way above audibility but the physical principles are still the same.

I made a special set of 2½ octaves of wedge-shaped thin aluminum bars tuned to the 13-tone equal temperament. I chose these bars because of their bland mellow tone with the inharmonic upper partials very subdued. This tames 13 enough to make it acceptable, whereas 13-tone on an organ or synthesizer would be extremely harsh.

Another nonharmonic partial deal that people should know about because these things are often heard, are those Tubular Chimes where the lowest partial or two partials are below the note taken as the useful nominal pitch. This sets both an upper and a lower limit to their compass -- below a certain point extremely high partials become the loudest and make the nominal note useless. Above a certain point those extra-low partials take over and drown out the nominal note, causing Confusion.

Then the toy piano that has little steel rods clamped at one end shows this phenomenon -- the "fundamental" or lowest partial is way down there and can be heard mainly in the topmost notes of that instrument. Both tubular chimes and toy pianos of that kind share the property that the most harmonious chord on them is the ¼-octave set called the Diminished Seventh Chord by traditionalists. Common chords and even octaves may sound out-of-tune on these instruments, while the diminished seventh, which is supposed to be a disso-

nance, sounds more consonant than they! The so-called Laws of Harmony are thus turned upside down and regular music teachers will ignore this as hard as they can. By building special instruments, we can change those rules to suit ourselves!

Ivor Darreg

THE NBILF MANIFESTO

The secret is out! A shot across our bow but we won't bow in to pressure. We were doing so well here at the National Bowed Idiophone Liberation Front (NBILF), quietly rending away at the fabric of American society. Yes, we admit it, "undesirable tendencies" is the avowed goal of our militant wing, the dreaded Democratic People's Bowed Idiophone Army (DPBIA). So, resin to the ready, waterphones to the fore, upstroke, downstroke, into the valley of Muzak. Remember the Mothra!

Joe Cochran

From the editor: Our West Coast timpanist and expert gongmaker Rick Sanford submits the following letter in response to Jonathan Haas' request which appeared in EMI's February issue.

Dear Mr. Haas:

I have received my issue in which you request assistance with an experimental timpani project.

My first two questions are: (1) Of what material are these 63" bowls made? (2) What shape are they; spheroid, paraboloid, conical, etc.?

These will be the most determinate factors in the sound of such a drum. I imagine that if your bowls are a salvage item (like the many eight-foot beer vats lying around the South of Market area in San Francisco), then they are most likely a stainless steel or aluminum alloy. The shape, of course, will be a matter of much discussion, with the recent trends and opinions surrounding ideal

(continued on page 4)

CORRECTION

On page 14 of Buzz Kimball's article on the refretting of plucked string instruments in EMI's last issue (Vol. III #6, April 1988), an incorrect formula for calculating fret locations for just intervals was given. Rather than the nonsensical configuration given there, the formula should read:

$$\left|\left[\left(L/X\right)+Y\right]-L\right|$$

Apologies to the Buzz and to our readers for the mistake.

FROM THE PAGES OF EMI VOLUME III
EMI's Third Cassette Tape Now Being Released

We happily announce that EMI's third cassette tape, From the Pages of Experimental Musical Instruments Volume III, is being released concurrently with this issue. It contains music from instruments featured in EMI in the six issues of EMI Volume III, spanning the period from mid-1987 to mid-1988. Instruments by sixteen different builders appear, providing an excellent complement in sound to the year's articles.

As with EMI's previous cassettes, the pieces are wildly diverse, with strange & familiar, soothing & startling, silly & serious all getting more or less equal time. A tiny booklet providing information on the instruments will be found inside the cassette box.

The Volume III tape, as well as Volumes I and II, are available to EMI subscribers for $6 apiece, and to non-subscribers for $8.50. Checks should be made out to Experimental Musical Instruments, PO Box 784, Nicasio, CA 94946, USA. For convenience, readers may wish to use the order form envelope bound into this issue.

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SUBMISSIONS: We welcome submissions of articles relating to new instruments. Articles about one's own work are especially appropriate. A query letter or phone call is suggested before sending articles. Include a return envelope with submissions.

timpani design. Some computer-aided experimentation might be of help: we all know that piccolo timpani need different bowl dimensions than 32" drums, and, likewise, a 63" instrument will have its own set of physical problems. Might I add that a modification of your bowls would be a simple undertaking, considering the wealth of metal spinners and fabricators, especially here on the West Coast or, in your neck of the woods, Buffalo.

In response to your question of how the drum might sound, a membrane which is increased in area by two will produce a fundamental an octave below. The 63" drum has an area over four times that of a conventional 32" timpano, therefore its operating range will be some two octaves lower. If an ideal pitch on the 32" drum is an F or G at the bottom of the bass clef, then that F or G on the 63" drum will be below the lowest note on the piano, with a fundamental of around 24 hz.

Let me recommend that the conventional plastic head material will do not better for this drum than it does for a concert bass drum, and that you pursue finding a large oxen or bull natural hide. Drums of over six feet across have been made with natural hides in the past, and it certainly should not be a compromise in this case. If you'd like any help fabricating a flesh hoop and tucking the head, I'd happily donate my time.

I'm sure many of the EMI readers and listeners would like to see the drum complete. I'd like to see also a 38", 50", etc. graduated set so that coherent musical lines could be played.

Good luck with the project, and let me know when you find out more about these bowls.

Rick Sanford

EMI IN TOP TEN!

A playlist from WBER radio in Penfield, NY, reveals that EMI's cassette tape, From the Pages of Experimental Musical Instruments Vol. II, was number 7 on their top 15 cassette only releases, behind "Anal Bliss" by the Ginger Leigh Band, but ahead of "1-800-GOD-HOUSE" by Barkmarket and "The Pitfalls of Illogic" by Any of Several Weasels.

INSTRUMENTS

A HARMONIC ENSEMBLE

by Michael Meadows

In an earlier issue of **Experimental Musical Instruments** (Vol.III #2, Aug. 1987), Michael Meadows described his trumpet marine, a contemporary model of the medieval bowed string instrument played in harmonics. Michael's trumpet marine is one component of an ensemble of instruments designed specifically to articulate the pitches of the harmonic series. In the following article Michael describes the remainder of the instruments in the group, along with some of the thinking behind the ensemble and its music.

Music of the harmonic ensemble can be heard in the cassette **From the Pages of Experimental Musical Instruments** Volume III, being released simultaneously with this issue of EMI.

There is an ongoing discussion over which is the "best" tuning system -- just intonation; well-tempered tuning; 19-, 31, 43, 53- or 64 tone temperament; etc., etc..

It seems like an awfully big brouhaha over a bunch of notes.

Nevertheless, there are alternative ways of thinking about music -- assuming, of course, that it needs to be thought about. This article discusses one such alternative along with some of the instruments involved.

This idea is simple.

Abandon, if you will, the notion of constructing a scale. Forget about the concept of having identical scales within each octave.

Instead, start with single tone. Then add its natural harmonics.

These harmonics, or overtones, which are present in virtually every sound we hear, have frequencies which are whole number multiples of the frequency of the original tone -- the **fundamental**. (There are exceptions: many percussion instruments and large bells in particular sound inharmonics -- overtones which are **not** whole number multiples of the fundamental.)

Because they are generally much weaker than the fundamental, these harmonics, also known as **partials**, are rarely heard as separate pitches. Instead, their presence is translated by the brain and hearing mechanism into **timbre**.

A sound described as "bright" is generally found to be rich in upper partials, while a darker, somber mood is evoked by odd-numbered ones. In fact, the wide variety of sounds produced by organs as well as many synthesizers is basically achieved through the addition and subtraction of harmonic overtones.

In a more contemporary acoustic vein, some previously featured instruments in EMI -- Croset's lyra, Genovese's fipple pipes, Fullman's Long String Instrument, and the Puget Sound Wind Harp -- are all characterized by an essentially harmonic nature.

The ensemble of instruments I've created is an attempt at even further differentiation among

these partials. In addition to being a rich timbral resource, they make possible the development of melodic, harmonic and even rhythmic elements within the harmonic series.

Sharing a common fundamental frequency of 41.25 Hz (E1), the instruments are limited by design to only this pitch and/or its upper partials. The unplayable fundamentals of one section of the ensemble, the harmonic flutes, are actually an octave and two octaves higher, causing their harmonics to reinforce the even-numbered partials of the other instruments.

Now, because the frequency of every partial (P) is a whole number multiple of the fundamental (P1), there is an interesting result: these instruments cannot be played "out of tune," except on occasions when a pitch is intentionally bent. In addition, the combination tones produced by any two or more harmonic overtones are also harmonics and, as such, are in tune with that particular harmonic series. (Combination tones are audible additional tones, sometimes subtle and sometimes quite noticeable, which arise from the acoustic interaction of two pitches sounding simultaneously.)

For example, take the 6th and 7th partials (P6 and P7) of a fundamental tone of 100 Hz.

Frequency of P6 = 6 x 100 = 600Hz;
Frequency of P7 = 7 x 100 = 700Hz.

P6 + P7 Summation tone: 700 + 600 = 1300Hz;
P6 - P7 Difference tone: 700 - 600 = 100Hz.

100 and 1300 Hz, then, are the frequencies of the primary combination tones, which, as you can see, are equal to the fundamental and the 13th partial, P1 and P13 respectively.

The simplicity of this tonal relationship is matched in the instruments of my ensemble.

They are principally aerophones made from plastic pipe. They have no fingerholes; pitch is altered by varying the embouchure and the velocity of the breath. Some provide a fundamental drone; others are melodic. Some are capable of both. Different mouthpieces and a variety of playing techniques are used to produce a considerable range of pitches and timbres.

AEROPHONES

Didjeridoo and contrabass didjeridoo
Baritone and alto fipple pipes
Baritone, alto and soprano notched flutes
Reed pipe

Most of these instruments have historical precedents in other cultures -- the spirit flutes of Papua, New Guinea; the **urua** (fipple pipe) of Brazil's Camayura Indians; and, of course, the didjeridoo.

The Didjeridoos:

The didjeridoo is an Australian aboriginal instrument which has been in use for centuries. Traditionally made of wood, its reedy, lip-buzzed drone can be articulated by flips and trills of the tongue and modulated by humming and varying the oral cavity. Through the technique of circular breathing, this hollow tube can be kept droning continuously -- at least until the lips collapse.

The two didjeridoos in the ensemble, with sounding lengths of approximately forty and eighty inches, are 1½" in diameter with 1¼" PVC pipe adapters for mouthpieces. Because they function as closed cylindrical pipes, their fundamental tones are an octave lower than those of open pipes of identical lengths. This means that the shorter pipe has a fundamental of 82.5 Hz, an octave higher than the longer contrabass. But because closed cylindrical pipes resonate only odd-numbered partials, the combination of the two didjeridoos yields a set of overtones which is an almost complete harmonic series of P1, lacking only a few upper partials which are supplied by the flutes.

The Notched Flutes:

The longest (c. 81") of the three notched flutes in the ensemble is a 3/4" diameter pipe possessing a playable range of P3 to P12. The ½" diameter flute half this length sounds P3 to P8, which is the equivalent of the long pipe's even-numbered harmonics between P6 and P16.

There is a solid, meditative quality about the tone of these flutes. It is warm, yet with a fine edge -- not unlike that of the Japanese shakuhachi. In performance, the sound is slow to develop, beginning almost inaudibly and taking a second or two to bloom into full volume. Shifting from one harmonic to another happens almost as if by osmosis -- one pitch fading as another takes its place.

In contrast, the shortest of the notched flutes (about 20" long; ½" in diameter) can be played quite rapidly by opening and closing the far end with a fingertip. The resulting set of partials -- those of an open pipe and those of a closed pipe -- is equal to the harmonics of the open pipe twice its length.

The Fipple Pipes:

The ½" diameter fipple pipe, has a usable range

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THE FIRST 16 PARTIALS OF E-41.25 Hz:

PARTIAL NUMBER	INTERVAL ABOVE FUNDAMENTAL (in cents)	PITCH	FREQUENCY (in Hz)
1	fundamental	E1	41.25
2	1200 (octave)	E2	82.5
3	octave + 702	B2	123.75
4	2 octaves	E3	165
5	2 octaves + 386	G#3	206.75
6	2 octaves + 702	B3	247.5
7	2 octaves + 969	⇓D4	288.75
8	3 octaves	E4	330
9	3 octaves + 204	F#4	371.25
10	3 octaves + 386	G#4	412.5
11	3 octaves + 551	⇓A#4	453.75
12	3 octaves + 702	B4	495
13	3 octaves + 841	⇑C5	536.25
14	3 octaves + 969	⇓D5	577.5
15	3 octaves + 1088	D#5	618.75
16	4 octaves	E5	660

of P8 to P32; the 3/4", from P6 to P24. Both are in the 80" length range. Though precise pitch determination is somewhat elusive, the problem is partially solved in the P6 to P16 range by using a flexible hose for the 3/4" pipe instead of rigid plastic pipe. Slightly pinching this hose at a particular point while blowing encourages the air column to vibrate in a manner in which a node is formed at the point pinched.

For example, a point located about 10" from the fipple is the site for the first node of P4, the second of P12, the third of P20, etc. In practice, however, it is P12 which sounds readily. Also, because pinching more or less stabilizes the vibrational mode, a pitch can be played more loudly without the threat of overblowing.

The Reed Pipes:

The reed pipe in the ensemble (c. 80") is 3/4" diameter CPVC pipe with a clarinet mouthpiece. In order to sound its fundamental a relatively thin, flexible reed must be used. A clarinet or bass clarinet #2 reed is adequate, although its life expectancy is rather low. The usually obnoxious squeakings of the reed are transformed into almost horn-like tones which can be controlled by the embouchure and a strong jaw.

A 28-foot version of this instrument is as interesting as it it difficult to play. The previous 10 Hz fundamental becomes a rapid flutter and the squeaks turn into a drifting pulse of harmonics.

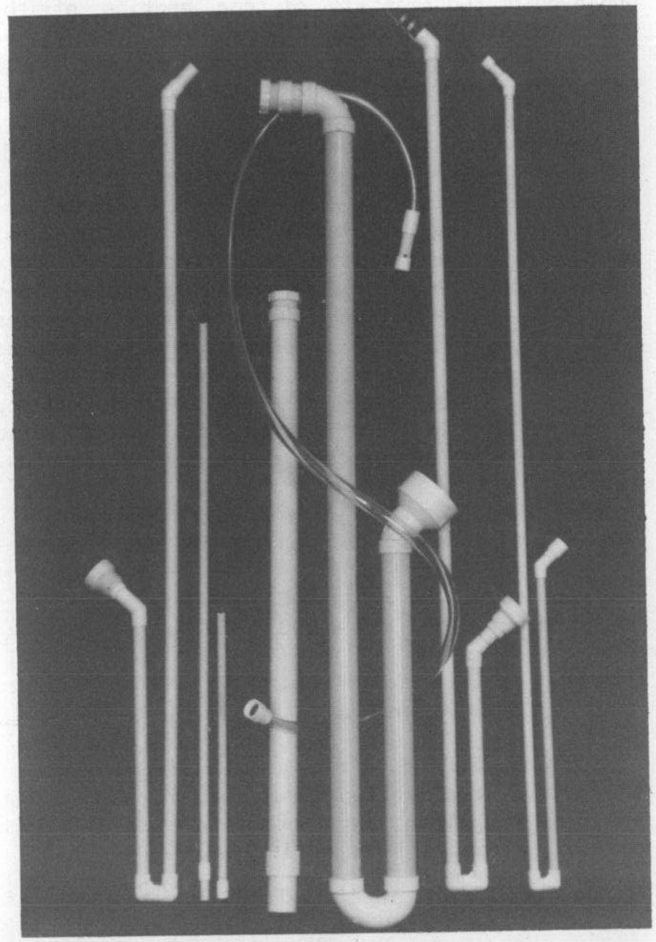
One possible future development in the aerophone department involves curving the pipes themselves instead of using angle connectors. The problem with angle connectors is that some dropout of upper harmonics occurs in the ½" fipple pipe because of the severe bends. Other pipes appear to be unaffected. Also, the contrabass didjeridoo could use a spit-valve.

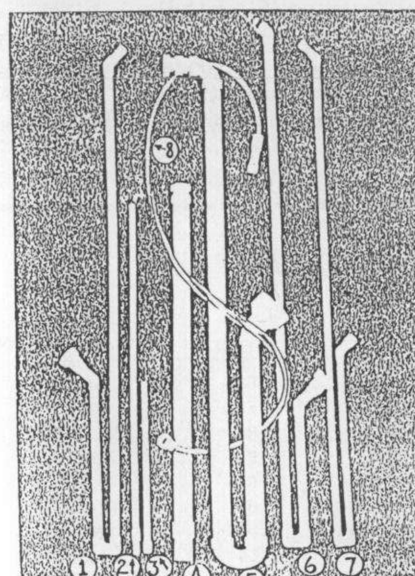
STRINGS

One stringed instrument completes the ensemble: The trumpet marine, a bowed chordophone described at length in EMI Vol III #2, is the most versatile of all these instruments. Touching one of its two playing strings at the proper node and bowing at the corresponding antinode will sound any specific partial between P1 and P64. Upwards of P16, accuracy of pitch becomes increasingly difficult, although whatever partial does sound is quite clear. Simply bowing the string without touching it creates anything from a vibrant drone to an obnoxious shriek. The adjustable vibrating bridge adds yet another facet to its tonal resources.

Alone, any one of these instruments has only a modest range of expression. Together, they form a primitive yet oddly elegant ensemble capable of creating a wide range of moods. The music is born out of the vital rhythms of breath and lives in the simple harmonic nature of not only the instruments, but the hearing response as well. Flutes sing ethereally over a primeval drone... a single melodic voice is overpowered by its constituent harmonics... edge-tones flit, gnat-like, around a bestial chorus...

But remember -- it;s just another bunch of notes.





MICHAEL MEADOWS' "PRIMITIVE YET ODDLY ELEGANT ENSEMBLE"

1. Baritone notched flute
2. Alto notched flute
3. Soprano notched flute
4. Didjeridoo
5. Contrabass didjeridoo
6. Reed pipe
7. Alto fipple pipe
8. Baritone fipple pipe

MUSIC FOR HOMEMADE INSTRUMENTS

By Skip La Plante

Experimental Musical Instruments has been running a series of articles on the use of natural materials in instrument building, with recent features on gourd and bamboo, and several others to come. We hear now from a builder who works with the most readily available of natural materials in the city today.

MUSIC FOR HOMEMADE INSTRUMENTS is a composers' collective based in New York City that invents, builds, composes for and performs on musical instruments made form trash and found objects. It was founded by Carole Weber and I in 1975 to showcase our compositions for dance in a musical forum. I had been experimenting for about a year with instruments made from found materials, while Carole was working with an eclectic mix of instruments from all over the world. Initially it seemed we spent most of our time creating new instruments; over the years our focus has shifted to composing for them.

The group now has six members. We all compose for the instruments and play in each others's pieces. Current members include Alice Eve Cohen, Geoffrey Gordon, Rolf Groesbeck, and David Simons, in addition to Carole and myself. While all of us have built instruments, I've been by far the most committed to creating new instruments.

The instruments are created to sound good and to be easy to play. The reigning visual aesthetic is: if it sounds good, leave it alone. Certainly no effort has ever gone into cosmetic alteration of the everyday objects used to make noise.

The instruments are used regularly. All members of MFHI compose music for off-off Broadway theatre and dance productions, as well as for MFHI. The instruments must be adaptable enough to meet whatever compositional needs arise in this ever-changing environment. The instruments must be portable enough to be moved easily from one rehearsal or performance space to another as often as several times a day, usually without the use of an automobile. They are stored in a fifth floor loft with no elevator, so they must be light enough or modular enough to go up and down the stairs as necessary.

All of these factors have helped define what MFHI has built, but the main factor has always been cost. There has never been an abundance of money to buy and experiment with really good acoustical materials. But America generates an incredible amount of trash. Constantly. Most of it is free for the taking. Some of it can be made into things that sound good. More of it can be used to make unusual sounds that can be of use to us as composers. (There is plenty of room for discussion about what sounding good means. However you define good, bowing a styrofoam box does not sound good. That sound is useful to me as a composer).

The instrument collection probably numbers about 200 but is informal enough at its edges so that it would be absurd to count. Many instruments are made from materials fragile enough so that they aren't expected to last indefinitely. Since we are usually working with objects that are easily obtained, such instruments can be quickly replace if damaged, lost, stolen or otherwise incapacitated. If a fire destroyed the entire collection, it could be substantially recreated in a few months at virtually no cost.

What MFHI has created is a library of sounds using a huge variety of cast off materials. Most of the instruments have names, which avoids problems like "give me that plastic tube thing over there." Some names are taken from the items imitated. Harry Partch inspired the cloud chamber bowls and kanon. Third world instruments like ektaras and bull roarers lend their names to our version. Many names are contractions of the names of the items involved. Coba is COnduit marimBA.

MEMBERS OF MFHI, left to right: Skip La Plante, Rolf Groesbeck, Geoffrey Gordon, Alice Eve Cohen, David Simons. Not shown: Carole Weber.

Photo: Nancy Reyner

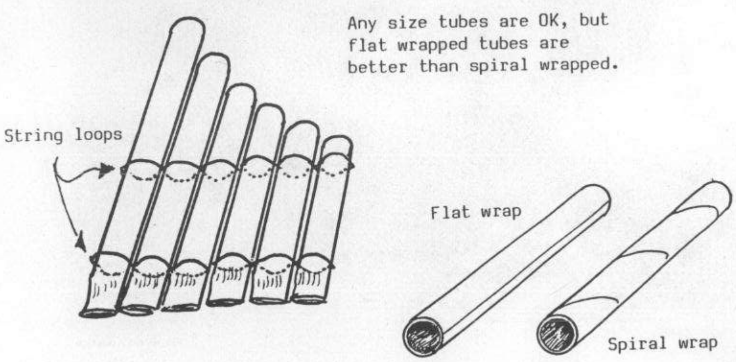
Some passages from this article, as paraphrased by Iris Brooks, appeared in the last issue of Ear.

Carimba is CARdboard tube marIMBA. Other names are whimsical. Stonehenge consists of C and L shaped pieces of cinder block. The Boweryphone is a collection of pint wine bottles. I used to take great delight in naming things but I realized that names were making it harder for people to figure out what I was talking about. People know what pipes are, but don't know that cobas are collections of pipes. As a result I now tend to stress description of the materials involved and downplay the names.

The bulk of the collection is idiophones: collections of like objects to be rubbed, shaken or, most often, struck into sound production. For many of these objects tuning is difficult or impossible. Harry Partch had to rescore his works whenever a cloud chamber bowl broke, because he couldn't know what pitch he was creating as he cut each bowl, nor could he alter the pitch of a cut bowl. Several of our instruments are as finicky, most notably glass instruments such as icicles and cloud chamber bowls and the cinder block stonehenge. A substantial proportion of our compositions require no fixed or absolute pitches. If something breaks between performances it can be replaced without stress. In fact, the whole early thrust of the instrument building was to collect as many good sounding objects as possible with no regard at all for tuning.

Other idiophones are tuned. 16 sets of cobas exist in tunings of 13, 14, 15...23, 24 and 31 equal temperaments, plus three just scales including Partch's 43 pitch per octave scale. Unfortunately scrap electrical conduit is full of nonharmonic partials which mask the justness of just intonation, so I don't use these instruments much. Several carimbas (sets of heavy cardboard tubing with one end crushed) have been tuned conscientiously. These scales include 31 equal, slendro/pelog (for use as a practice gambang), and just (5 limit denominators). Perhaps the carimbas are actually struck aerophones, with a vibrating column of air excited by hitting a membrane consisting of the tube itself where it has been crushed at one end. Length is proportional to pitch, so a rough ratio tuning is possible simply by measuring the longest tubes and making the others proportional. Fine tune by sawing off the ends of the tube to raise the pitch or wrapping heavy tape around the tube slightly overhanging or covering the end to drop the pitch. The latter damps the volume of the tube, but gives it a predictable pitch. Tape overhangs of over ½" tend to get smashed into end coverings in the course of things.

CARIMBAS -- Cardboard tubes crushed at the ends.



Often tuned instruments can be assembled from large collections of items. A 13 equal set of cloud chamber bowls was created by taking appropriate bowls from a larger set cut with no tuning in mind. The recent addition of two broiler pans gives us a complete set of pelog kempul in our simulated gamelan. These five pans are part of a collection of about 25 pans used in ever changing configurations. In this way we can accumulate a tuned set of almost anything given enough time. We hold no allegiance to a particular tuning and feel free to experiment with whatever amuses us.

The vast bulk of our instruments copy third world instruments, often substituting some form of readily available trash for an exotic material (which is usually not at all exotic at the place the original instrument was created). We have most often approached third world cultures piecemeal, borrowing something from India, then something from the Inca tradition, perhaps something from West Africa.

Recently I've begun to serious study Indonesian music. I had an opportunity to write a piece for an Indonesian style performance (**Ramayana** done in West Java style performed by East West Fusion Theatre in conjunction with Bali-Java Dance Theatre). I decided to make a gamelan for the occasion, pulling stuff off the shelf that would work and making other instruments from scratch as necessary. I was interested in getting instruments with timbres and registers similar but not necessarily all that similar to the central Javanese gamelan. In the interest of not writing a book about Javanese gamelan here, let me refer readers who are unfamiliar with the instruments to Jennifer Lindsay's fine introductory book **Javanese Gamelan** (Oxford 1979) for a description of the Javanese instruments.

I started with the **colotomic** instruments, which mark the extended rhythmic cycle of Javanese music. Individual colotomic instruments are played at specific and exclusive points in each of the several cycles that constitute specific forms in Javanese music. Analogously, a cuckoo clock indicates specific points on the twelve hour cycle it tracks with specific but changing signals on the hours and less elaborate signals every fifteen minutes.

The gamelan uses a huge **gong ageng** and several smaller **gong suwukan** to define the end of rhythmic cycles. **Kempul** are smaller hanging gongs of the same shape that mark salient points in each cycle. All of these instruments are bronze shells as large as four feet in diameter and up to seven inches deep, struck on a raised knob located at the center of the instrument. The gong ageng is a single gong pitched at a low (subsonic in some cases) and usually indefinite pitch. The other instruments come in sets of several pitches.

I went through my broiler pan collection and took the best sounding pans, and of those found several that produced some semblance of a **pelog** scale. Pelog is a seven note scale that varies somewhat from gamelan to gamelan and village to village. Any reasonable approximation is thus

legitimately in tune. Broiler pans are those large metal pans underneath the oven in stoves. Metal dish drainer pans work well sometimes. Later I discovered metal refrigerator drawers. Now I use only drawers for the gongs, with broiler pans used only as kempul. All of these instruments must be used suspended from racks using heavy twine tied through two holes drilled (or often found) in the pans. Bowline knots are an efficient means to insure that the string touches the pans as minimally as possible.

Kenong, ketuk and **kempyang** are knobbed pots placed open side down across two pieces of string or rope. These instruments decrease in size from kenong to kempyang. Kenong is a set of all the pelog scale pitches, while the others are single pitches.

In place of kenongs I use a set of large stew pots. Galvanized pots seem to make the best sound, but any pot flipped over and laid on a rug could work. The hard part is finding pots that just happen to make the right pitches. Broiler pans and stew pot kenong were the least tunable items I used, so once I had these other instruments were tuned accordingly.

For kenong and kempyang I use two hubcaps laid on a rug.

In Javanese music, the **balungan** instruments carry the melody. **Sarons** of several sizes playing in different registers constitute the bulk of the balungan instruments. These all consist of relatively flat metal bars secured at the nodes over trough resonators. The **slentem** is an exception which I made no attempt to duplicate.

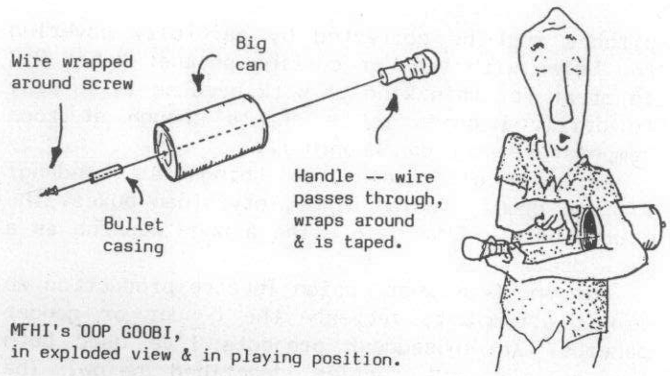
I only needed one instrument to simulate this whole family so I cut electrical conduit pipe to pitch and laid three octaves worth over an open styrofoam box.

The remaining Javanese instruments include a range of instrument types. Functionally these are the **panerusan** instruments which ornament the balungan melody in numerous ways. They include **bonang** and **bonang panerus** (smaller knobbed pots also suspended on ropes -- each instrument has a two octave range), **gambang** (a four octave wooden xylophone over a trough resonator), **rebab** (a two string bowed lute), **siter** or **celempung** (multi-stringed plucked zithers), **suling** (an open hole bamboo fipple flute), **gender** and **gender panerus** (flattened bronze keys suspended over individually coupled resonator tubes; slentem mentioned before is actually a bass gender), and **kendang** (drums).

I simulated bonang with electrical junction boxes laid open end down on a rug. The junction boxes only minimally represented the pelog pitches. Eventually I will find enough boxes to pick out a pelog set.

Gambang was simulated with cardboard tubes (the carimbas described earlier) laid on a rug.

Our rebab is an off-the-MFHI-shelf job. Our coffee can oop-goopi makes a fine rebab. Traditionally oop-goopi or goob-goobi is a north Indian instrument which uses a wire anchored to a gourd resonator at one end and fastened to a handle at the other. The wire is tensioned by anchoring the gourd between one elbow and the hip, then pulling the handle away using the hand of the same arm. The string is then plucked with the other hand.



MFHI's OOP GOOBI,
in exploded view & in playing position.

In MFHI's instrument, on end of a thin metal wire (I found the wire and have never measured the gauge or determined the material although I suppose it is steel) is wrapped around a screw. The other end is fed through a hole drilled in the bottom of a bullet casing, then through a hole drilled in the bottom of a coffee can of which the top has been removed and fastened to a wooden handle. The screw fits into the bullet casing. This assembly anchors the string to the can which substitutes for the gourd as a resonator for the string. The string can then be plucked or, in this case, bowed with the other hand. As an old bass violinist, I have some bows around.

Celempung was replaced with the kanon I had built about ten years ago after looking at pictures of Partch's harmonic canons. Mine has seventeen strings (the number is variable up to twenty-four) of bronze wire each one meter long, tightened via turnbuckles over a board which I think was the wooden piece found between the keys and the pedals of an upright piano. All of this sits over a 2x4 frame which prevents the board from warping under tension. The front and back braces are thicker than the longitudinal braces. This leaves space between the longitudinal braces and the floor for sound to escape from the resonating chamber formed by the instrument and the surface it sits on. To dampen the instrument, put it on a rug. The strings are all the same gauge wire (found in a barn in New Jersey -- somehow about 3/4 of these strings have lasted for over ten years and are still playable). They are tuned with metal bridges that were cut from a traffic sign that was laying in the street after a truck had run over it. This instrument is the best advertisement of all for the notion that you shouldn't worry too much about building an instrument perfectly. I had no idea what I was doing when I did this, but this instrument roars.

I made a transverse flute tuned like a suling out of a piece of 3/4" PVC pipe. I drilled holes every ½" or so along the full length of a dummy pipe. I drilled a mouth hole hear the end using a 5/8" drill bit, then plugged the end with a cork. By covering most of the holes with tape and seeing what pitches I got with the remaining open holes, I could locate the pitches I wanted along the tube without doing any calculations. If you don't like the pitch at a certain hole, cover it with a piece of tape taken from another hole. Eventually you wind up with a tube covered with tape except for a few well placed holes. I then cut small versions of these holes into a second tube, enlarging the holes when the resulting pitch was flat. Sharp

pitches must be corrected by partially covering the holes with tape or cutting another tube. PVC is great for this kind of work because it is easy to drill. I guess it is stable enough at room temperature, but don't burn it.

We used all manner of things as kendang: African drums, Indian drums, styrofoam boxes, the floor. Lately I've been using a huge washtub as a bass drum.

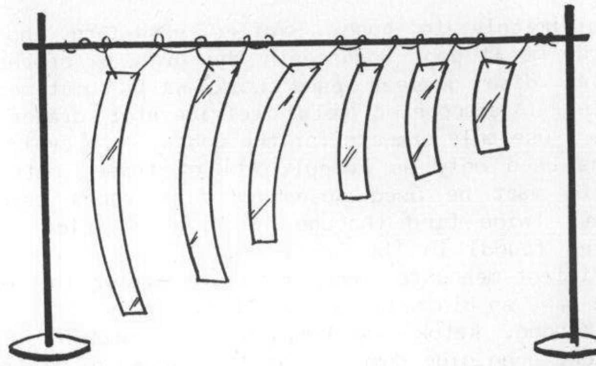
For the East-West Fusion Theatre production we didn't attempt to recreate the gender or gender panerus. In subsequent projects I've used both the metimba and turtles described below. The metimba is closer in sound although neither instrument is tuned appropriately.

We also used a set of instruments we called alternative colotomics for one section of the Ramayana production. Gong was replaced with a huge stainless steel bowl that originally was part of a food service tray. I found it in the middle of the street one day. Kenong was replaced with a combination of Korean brass bowls and heavy stainless steel mixing bowls. Kempul was replaced with ½" diameter solid glass rods 4-5' long laid across styrofoam boxes. Kempyang and Ketuk were the same hubcaps.

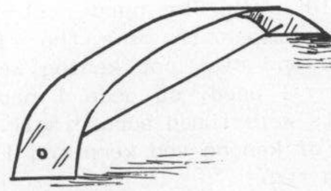
You could use this information to create your own gamelan. I include it more with the idea of demonstrating the extent to which MFHI has turned to the third world for ideas about musical instruments. On the other hand, because we are not using traditional materials, we are not getting a traditional sounding ensemble. Also we are not using the instruments we have to perform traditional music, but rather some amalgam of ideas from widely ranging sources and cultures. The result may invoke various third world traditions, but definitely has a life outside any of the traditions.

I've built several instruments that are not modeled after anything in the third world, most particularly the three instruments made of curved steel strips: metimba, hanging metimba and turtles. The general principle for these instruments is that of the musical saw -- metal under varying stress will produce varying pitches. Stress is created when the strips are bent into long arcs.

The source for the strips was a barn in New Jersey. There was a pile of about 800 eight foot long strips four inches wide about 1/32nd of an inch thick. They had been in that barn for ten years when I got there. The top half of the pile was rusted, but the lower ones were shiny. Just tapping the shiny strips produced a fairly clear ringing tone that was drastically affected as the end of the strip moved around when struck. The first formal instrument built was a steel loop with the ends bolted together. While these instruments sounded great, the loops gave way to gravity eventually and began not to sound so great. But three to five foot lengths of the steel gently arced to mimic those loops sound pretty much the same and do not lose it over time. These are our hanging metimbas. Holes are drilled about ½" from from both top corners. Heavy string or wire is run though the holes to tie each strip to a horizontal bar. A full instrument is six strips ranging from about eighteen inches to four



Above: HANGING METIMBA
Left: METIMBA
Below: TURTLE



feet or so. Pitch is more a function of curvature than length so the dimensions can be very approximate. It is normal for shorter strips to be producing lower pitches than longer strips now and again. Getting a strip curved enough to sound interesting without curving it too sharply (which makes the sound produced a flat crack rather than a wavery sustain) is not so easy. Once a strip is bent too far, it can't be unbent. It reverts to trash. Ditto for dented strips, since dents are effectively sharp curvatures. The strips can be struck in any number of ways with any number of things. The sounds it will make fall into three categories. When the edges of the strip are struck, a short, identifiable pitch with a fair cluster of nonharmonic partials in produced. When the strip is hit towards the middle of the flat surface, it undulates with the force of the blow. The sound produced is less definable. Like a cymbal, it can't be said to have a distinct pitch. On the other hand, the frequency cluster you hear goes up and down as the strip undulates. Finally, the strip can be friction excited, with a superball (which is difficult and not all that effective) or by blowing the edges of the strip. The sound produced resembles whale calls.

The metimba is a similar set of strips laid on a soft pad rather than hung. The strip is placed so that the curved middle of the strip rests on the pad and both ends are in the air about two inches off the pad. The ends are struck with something soft, usually a timpani stick. The sound evokes an mbira. The principle is the same. Unfortunately, there doesn't seem to be a good way to attach a resonator to the strips. This means the instrument can only function in quiet circumstances. It produces a clear, ringing pitch made very distinct by the fact that both ends of the strip are moving. The pitch of the strips is fairly stable once established, but the strips have to be handled carefully since any forced

bending of the strip will change the pitch, and usually mess up the sustaining ability of the best bent strips.

The turtles replace the very gentle bending of the metimbas with a single pair of fairly sharp bends about six inches from each end of a strip. A sharp bend consists of a gradual (parabolic) bend in the space of three inches or so that places the flat surfaces on either side of the bend into a 45-60 degree angle. The flat middle section might be slightly bent also. Once a strip is well bent (determined strictly by trial and error), a wire is run through holes drilled near either end. Knots in the wire prevent the curvature from flattening and thus safeguard the sound of the strip. The whole center of the strip undulates when struck, producing a glowing tone somewhat similar to the metimba, although both harsher and louder. Again a set of six strips is the standard unit, but often only three or four are used since each strip takes up a fair amount of floor space for a single pitch.

Another most unusual instrument I've created is the waterfall. Both of the waterfalls I've built used water falling onto objects to produce sound. Three variables affect that sound: the volume of the water, the height it falls from, and the nature of the material it strikes.

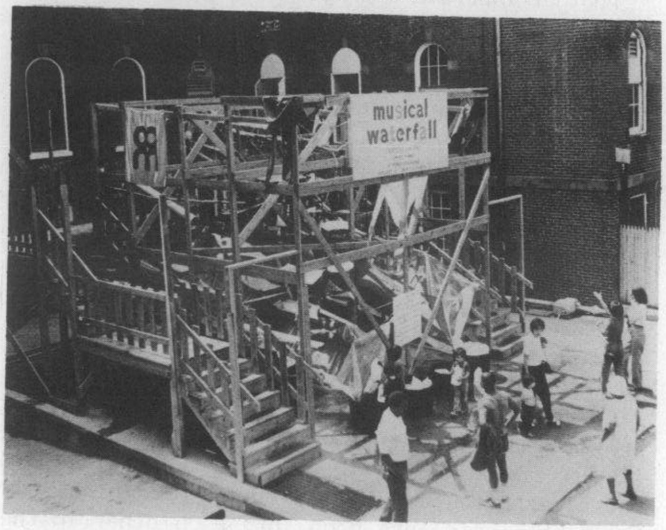
The first waterfall was an installation created at PS1 in New York in 1977. Working with Michael Canick of MFHI, in the center of a large room we created a large jungle gym consisting of broken doors, scrap 2x4s and three trunks cut by the utilities and not yet hauled off. Three layers of items were hung on this structure. The top layer was our delivery system, consisting of hoses and chutes made of tin foil and wood. Standing on a platform (the top of a closet built into the room) we could pour water from gallon jugs into the hoses only a few inches below the ceiling, thus maximizing vertical drop. It was also possible to bypass the hoses and chutes and pour water directly into the middle layer. The middle layer contained a huge variety of scavenged items, suspended from the jungle gym with rope and wire so that water from above would fall onto them and create a sound. Objects were placed so that water splashing off one object would fall onto others in discreet channels. The items included plastic sheets, metal plates and bars, wood scraps,styrofoam, rubber, tin cans and other local trash. The bottom layer was a series of plastic sheets which caught the water and channeled it into one of several large basins. Jugs were refilled from the basins and carried to the platform.

The second waterfall was built outdoors at the Capital Children's Museum in Washington DC in 1983. Conceptually the same, it was bigger and better. The tiny platform at PS1 was replaced with a 16' x 8' deck accessed by two stairways. The stairs were positioned to create a huge C shape with the platform. In the center of the C was a grid of 2x4s 16' square. Twenty-five chutes made of gutter pipe or 3" PVC leading to a huge variety of objects hung in the grid allowed visitors to pour water into the grid as they chose to. New items included old traffic signs, sixty soda cans tied together, plexiglas and vinyl sheets, plastic buckets, screens, and a kitchen sink. Carefully planned channels included a series of four inch drops in a chain of many materials; a pair of 12' drops (one onto wood and one directly onto the underlying tin roof); a series of tin cans with holes drilled in the bottom suspended in vertical columns; five screens in succession. Overall the pathways offered almost every conceivable height of drop onto almost every object. The understory of plastic sheets couldn't withstand Washington's violent summer thunderstorms and was replaced with tin roofing. Underneath the tin we created the listening cave, the only place you could really listen to all the sound the water fall made as water coursed through it without being distracted by watching either the water or the people. Again catch basins at the bottom allowed water to be recycled.

I found that both waterfalls spoke more directly to kids than to adults. At PS1, a prestigious artists' exhibition space, visitors were encouraged to take the initiative and pour water into the system. However a steep ladder leading to the platform dissuaded the frequently high-heeled visitors. I was beginning to lose faith until a twelve year old snuck into the building one afternoon. He saw the waterfall, headed right to the top and unleashed a flood. At CCM the kids took over the act, having no inhibitions at all about running up and down stairs with jugs full of water (and very little inhibition about pouring water on each other when given the opportunity -- fortunately the temperature in DC in the summer is usually in the 90s.)

It turns out that water won't make a bell ring because it dampens the vibration in the bell (by touching so much of the surface of the bell) to a greater degree than it induces vibration in the bell by crashing into it. We used a cymbal at PS1 that sounded well when water hit it, but a cymbal would probably be stolen in short order outside. Other attempts to make the waterfall make what we think of as traditional sounds of music tend to meet similar fates. The music is in the more subtle variations in the almost white noise of pouring water. I can't say I thought all the people who have played the waterfalls heard the

MUSICAL WATERFALL at the Capitol Children's Museum



music that I did, but there is something special there for those who listen. There is also something special there for those who may not be listening. I remember all the frustrated parents at CCM trying to get their kids away from the waterfall and into the museum.

Everyone creating musical instruments should know about styrofoam resonators. We use all manner of styrofoam boxes under collections of pipes, glass rods, metal plates, wooden bars and the like. The styrofoam acts as an all purpose trough resonator with the special property of not damping the vibrating object almost no matter where it is laid on the styrofoam. We only need to look for the nodes if we are planning to tie objects together. Styrofoam boxes seem to be useful in place of almost any other kind of resonator you might be contemplating. The only thing they lack is great structural strength, so strings can't be anchored to the boxes. Surprisingly they will take great weight. We use styrofoam boxes designed as ice chests for fish and boxes for huge shipments of flowers under larger objects such as 10' long 2x4s or conduit pipes. Smaller boxes such as picnic coolers and packaging for stereo components and computers are good for middle sized objects. Small boxes like the tops of egg cartons are good for the smallest objects, such as spoons. For some reason only precast boxes work well. Boxes created by gluing several styrofoam sheets together never do. Boxes full of strange styroshapes don't seem to work as well as boxes that have flat, straight walls along each inside surface. Styrofoam sheets work a little bit when objects are laid on them, but not nearly as well as boxes. One problem we have had is that pipes and round objects tend to roll around as they are struck The best way to keep such objects in place is to put tabs of duct tape on the styrofoam between the pipes. Start with a three inch length of tape perhaps half an inch wide. The middle inch of the tape is folded so that the sticky sides of the tape glue themselves together in a quarter-inch long tab. Rows of these tabs are attached to both sides of the styrofoam box. This is not a perfect solution, but it works far better than making notches in the styrofoam.

Another instrument of general interest might be the fojar, so named since the original version comprised four juice jars. I think we have about fifteen different size jars now. Glass jars with 2" diameter openings seem to be best. Each jar is a Helmholtz resonator. The airspace enclosed by each jar determines the pitch, with larger air space corresponding to lower pitch. Jars can be fine tuned by filling them with foreign material to raise the pitch. Candle wax works well since, once it hardens, it can't spoil or evaporate. Wax contracts as it cools, so it is often necessary to add wax to recapture a desired tuning in a recently cooled jar. Excessively sharpened pitches can be flattened by scraping out excess wax.

The airspace inside the jar can be excited by striking the lip of the jar with something soft like a timpani stick or a beach thong. The soft but clear pitch can be marred by two things. If the bottles and jars bang into each other in the course of being struck, you get the delightful sound of glass hitting glass. To avoid this, we wrap each jar with a sock. Finally, something useful to do with socks that have holes in them. Another problem sound is the sound of the stick striking the jar instead of the soft head when a stroke goes wild. Wrapping the handles of timpani sticks with something soft such as moleskin or molefoam for several inches solves the problems, but beach thongs solve the problem better by not having wooden handles. If you use this instrument you might want to tie all the jars together with a belt or rope since jars have a tendency to wander or even fall over when played rambunctiously.

Panpipes are related in many ways to fojars. Fojars are idiophones or more likely struck aerophones, while panpipes are blown aerophones. I've made them of electrical conduit pipes sealed at one end of the tube with duct tape, plastic cigar humidors (the best material for working with kids), and glass test tubes. Tune several tubes with wax as described above (of course leaving empty any tube that can be) . There are several ways to bind the tuned tubes together into an instrument that can be played. I prefer wrapping pairs of tubes tightly together with duct tape, then joining pairs to form quartets and in this way assembling as large an instrument as you wish to create. I often add a thin but rigid piece of metal or wood on both sides of the instrument under the last wrapping to ensure that the tubes stay in a straight line.

If there is a common thread to all of MFHI's instruments, it is that they all use found and generally readily obtainable materials in very straightforward ways to create instruments that sound good. There is no proprietary technology involved. There is no complex construction involved. I feel like anybody who wanted to duplicate our instruments could do it easily after having seen a performance. In fact I am loathe to sell instruments that can so easily be made. It seems stupid to pay me when you can take a few minutes and make something for yourself.

It seems that MFHI sometimes works slowly but inexorably toward a goal. There are two that are being approached in this fashion. MFHI is planning to release a cassette of our work. It has taken much longer than we though it would to finish in the recording studio, so there is no tape available as I write this. (Call at the last minute for future updates). Another very long term project is the writing of a book detailing how to make most of the instruments we use. This project has also been postponed into the distant future, but is eventually coming. Unfortunately for the spirit of free advertising, this means that there is nothing you could buy from us at this moment even if you were so inclined. Well OK, wanna buy the Brooklyn Bridge?

For further information about MFHI please contact us at 262 the Bowery, New York, NY 10012; (212) 226-1558.

INSTRUMENTS

MORE BASCHET SOUNDS: A MOSTLY PICTORIAL PRESENTATION OF ARCHITECTURAL WORKS, MUSEUM INSTALLATIONS AND EDUCATIONAL INSTRUMENTS BUILT BY THE BASCHET BROTHERS

Picture captions by Bart Hopkin and Francois Baschet; photos by various photographers.

Over the last quarter century, Bernard and Francois Baschet have built a wonderful array of diverse and innovative musical devices. In the October 1987 issue, **Experimental Musical Instruments** ran an article on the Baschet Brothers' work. After providing some background, that article focussed upon the mechanics of specific acoustic systems the Baschets have employed, as exemplified by several individual concert instruments. Balancing the technical orientation of that earlier discussion, we follow now with a primarily photographic view of Baschet sound sculpture, museum installations and architectural work.

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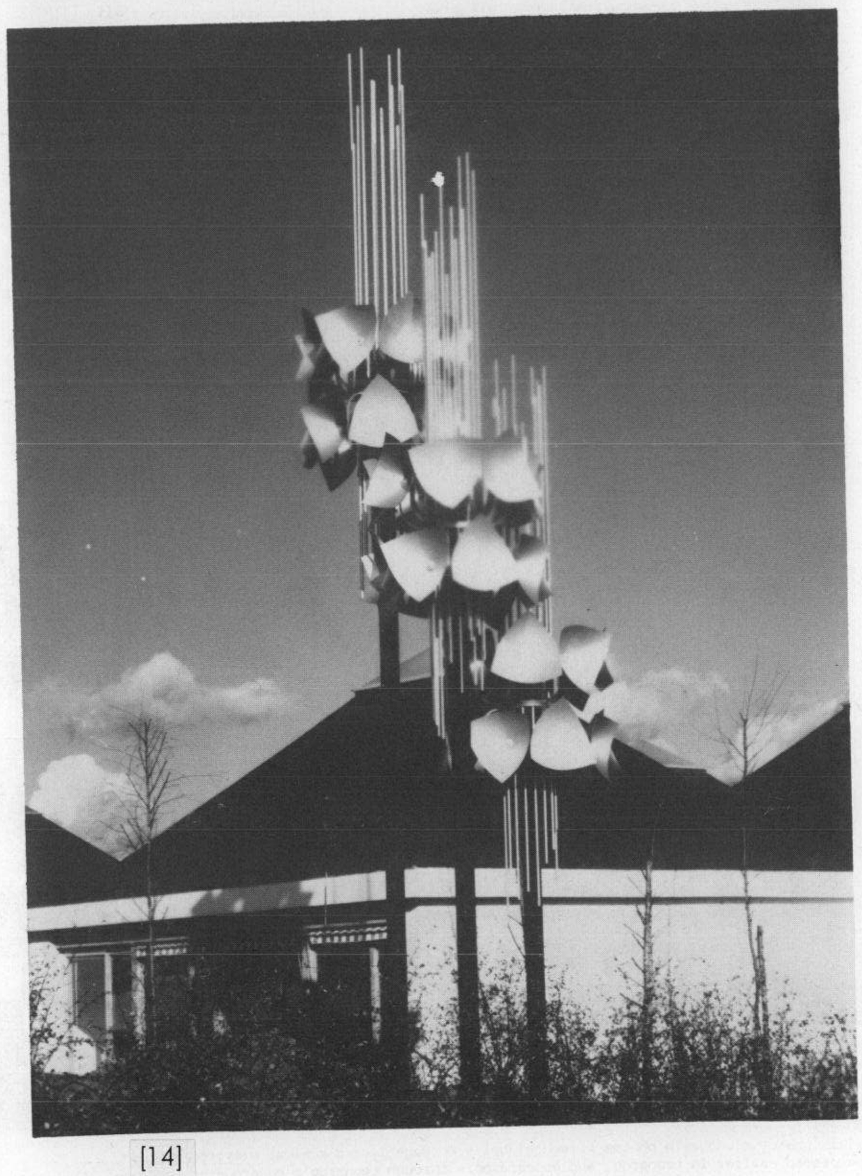
In the photograph below: the MUSICAL FOUNTAIN at the San Antonio Hemisfair, 1968. The visual elegance of this structure comes across immediately in this photograph. It takes a little more looking to begin to see how the thing works.

An essential part of the musical fountain, though it might not catch the eye initially, is a set of horizontally oriented water mills. There are twenty eight all told; three of them can be seen in the photo (though obscured by flying water) in the lower left corner, at center a little higher, and at right a little higher still. Around the periphery of the fountain are fifty-six water valves which can be controlled by members of the public. When water from the valves strikes the blades of the mills, they rotate under the hydraulic force. The rotating motion is communicated by a vertical shaft to a cluster of upright metal rods, one of which is fixed atop each of the twenty-eight water mill assemblies. Two of the rod fixtures can be seen unobscured in the upper center of the photo. While the rods remain stationary, the rotating shaft spins a ball hanging in their midst. It strikes the rods in varying musical patterns. The metal cones, whose handsome forms dominate the photo, are radiators for the sound of the rods communicated to them through the metal structure.

This photo, along with photos of school bells on page 14 and musical playground on 15, appeared earlier in Leonardo, and appears here through Leonardo's generous cooperation. [13]

Shown above are CHILDREN'S INSTRUMENTS. Bernard Baschet developed a number of instruments for use by children and in teaching situations. They are designed to produce attractive sounds in a manner that is completely accessible, meaning that no special training is required, and playing the instrument is possible even for a tiny child. The instruments are durable and may be dismantled for easy transport. In the photo shown here, children are playing metal percussion instruments with typical Baschet cone resonators.

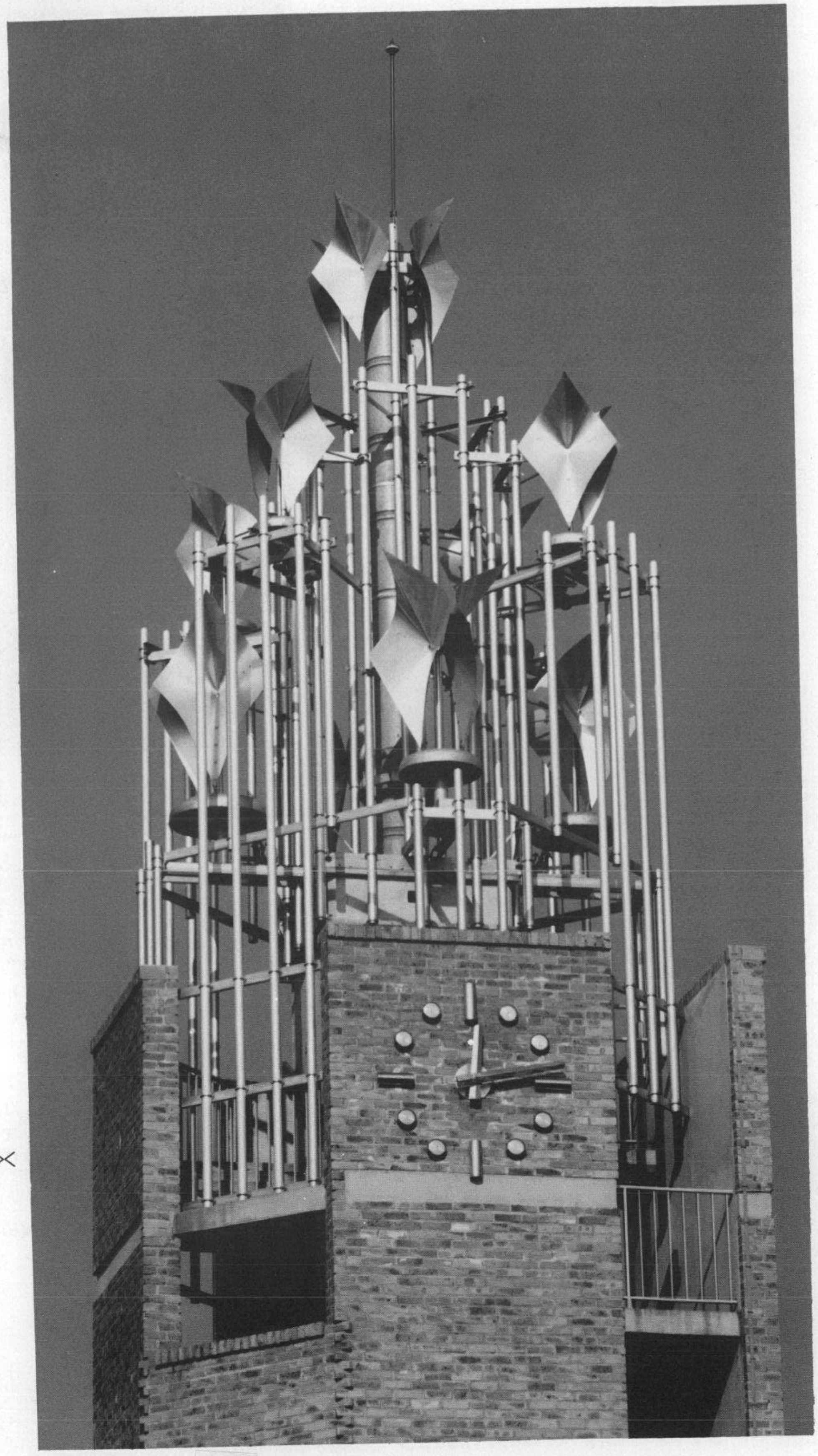


And at right, SCHOOL BELLS. The motor that sets these chimes to sounding is controlled by a school clock. They ring out the beginnings and endings of classroom periods as did the electric buzzer that segmented my school days not so long ago, and the hand-rung bell of an earlier time. Each of the three poles of the structure carries about 15 vertical rods. The rods are attached to and pass through a heavy metal disk, oriented horizontally (two of these are partially visible in the photo). Hanging balls, operated by the motor, hit the vertical rods, creating a pleasant chime sound which is broadcast by the bouquet of sound-radiating cones connected to the each of the disks.

In the photograph at right is a MUSICAL FOUNTAIN that was shown at Barbican Center in London, 1982. Below the tulip-like forms at the top of this photo are several gracefully curved tubes of running water. The water falls from the tubes into adjoined pairs of buckets that are free to tip from side to side on their mountings. As more water falls into one or the other bucket, the dual bucket assembly begins to tip in the direction of the fuller of the two. In the tipped position, the other bucket is positioned under the flowing tubes. It begins to fill and the dual buckets soon tip back to the original position and beyond. The oscillation thus initiated continues as long as the water flows. Meanwhile, attached at the bottom of the pairs of buckets are hanging balls which move as the buckets move. They strike small gongs positioned below, producing a musical sound to accompany the water sounds.

At left, a scene from the MUSICAL PLAYGROUND, Expo 70 in Osaka. The Japanese Steel Federation commissioned the Baschets to create what was identified as the world's biggest musical playground. They built seventeen entirely acoustic sound devices for the event. The vertical rods in the instrument shown here are sounded by striking with hammers or by friction with a piece of soft poplar coated with rosin. Acoustically linked to the metal cross bar supporting the rods is a single very large, shallow round radiating cone, looking a little like a sail in this photograph.

And finally, at right, a MUSICAL CLOCK TOWER. This bell tower is located in a recent building project near Paris. The bell structure in itself is sixteen meters high. The initial sources of vibration are the shallow, beret-shaped bells, about three feet in diameter, several of which can be seen in the lower part of the metal structure. They were originally manufactured as steel tank lids. When struck with ordinary bell-hammers, their tone is metallic, dominated by high partials. To bring out the lower partials and balance the tone, folded aluminum sound radiators -- the diamond-cone shapes in the picture -- are attached to the bells. (It is not immediately obvious in the photo, but the narrow tails of most of the radiators are affixed directly to the surface of the bells). The trick in balancing the tone is to find the best point on the surface of the bells to make the attachment, where the cones will most effectively reinforce the desired lower partials. That best point of contact was determined by trial and error. With the radiators in place, the lower partials of the bells can be heard over a good distance.



(Anniversary editorial, continued from page 1)

western and non-western cultures, as well as earlier invented musical devices that have remained obscure or fallen out of favor. So in recent issues we have offset our standard fare with articles on, for instance, wall harps, trumpet marine, stamping tubes, and some of Leonardo da Vinci's unrealized instrument plans.

On a more pedestrian level, another shift in content has been a move away from coverage of public events such as concerts. We have made this change simply because with our limited resources it has not been possible to do a balanced job of covering these things outside of a limited geographic area. In a related matter, it has also often been difficult to provide readers with timely information on coming performances, because concert times and dates have a habit of arriving at this office too late -- more often than not, EMI's next issue doesn't appear until after the planned event. Still, we like to receive such notices and do print them in the notices column when we get them in time. For those concert sponsors who have gotten timely information to us, the notices have proven valuable.

Who subscribes to EMI? The question comes up now and then, raised by readers who apparently wonder who ELSE in the world would be interested in something like this. At the time of this writing we have four hundred and sixty-odd subscribers (the precise number is always in flux). The vast majority of them are paid subscribers; the remainder are either other publications with which we have an exchange agreement or people who have contributed to EMI in one way or another (mostly by submitting articles) and are receiving a years' gratis subscription as a small thank you. Our readers are widely distributed throughout the U.S. and Canada, with all regions and both metropolitan and rural areas well represented. Foreign subscribers are scattered throughout the industrialized world, including most of Western Europe, Australia and New Zealand, and Japan. Third world countries are not well represented.

About a tenth of our subscribers are libraries or other institutions. Included are most of those which play a major role in the world of musical instruments (the Smithsonian, the Brussels Conservatory, the Boston Museum of Fine Arts, the Metropolitan Museum in New York, etc.). Among universities, most of those with the healthiest reputations, endowments and library systems are with us, as well as a number of smaller institutions that have made the laudable decision to allocate the funds. A few of the larger instrument manufacturing firms have subscribed, and a great many smaller and more adventurous companies.

We have never done a demographic survey of our individual subscribers, but by interacting with them from day to day we are able to develop a pretty good idea who they are. Most are actively working with musical instruments in one way or another; relatively few seem to be subscribing out of an intellectual curiosity not based in direct involvement. For a good percentage the interest is professional: they build, perform with, compose

for, dance to, or engage in commerce with musical instruments as part or all of their livelihood. Probably in the majority, however, are those who carry on their love affair with instruments even as, as a practical matter, they look to other means for putting bread on the table. Most of the readers seem to have broad musical interests, and are happy to continue working with standard instruments even as they explore other possibilities. The attitude that traditional instruments are somehow passe or reactionary (an attitude which people sometimes fear EMI represents) doesn't crop up much.

Many subscribers have special training of one sort or another, such as a cultivated knowledge of acoustics, ethnomusicology, or music theory, or special skills in woodwork, metalwork or electronics. But EMI has always hoped to minimize barriers to entry into its world, and, in fact, a lot of subscribers, including many of those with the most active and enjoyable involvement, come without any special background. Some others, as it happens, are visual artists who have found in sound sculpture an inviting point of entry to another world of aesthetic possibility.

As one who deals with them from day to day with EMI's subscribers and contributors, I can add these things: they are a very diverse group of people, and, without exception, a lively, curious and interesting bunch.

Some people may also be interested in how subscribers have found us or we them. Over its lifetime EMI has promoted itself primarily by modest amounts of paid advertising in other publications, some direct mail and, thankfully, a lot of word of mouth. We have also been fortunate in receiving some very good unpaid publicity. During this last year, we got on our promotional horse and undertook a more substantial program to bring EMI to the attention of potentially interested people (a "substantial program," that is, by our standards -- a tiny one by the standards of larger marketers). The results can be seen in the fact that the total subscribership number cited above, while still modest, is a good percentage increase over the same number of a year ago.

This latest effort, which is still underway, has been a direct mail program. We spent a lot of time thinking about just who would be interested in EMI and where we could get mailing lists that would reach those sorts of people. We then started with small test mailings to several different lists. Most of them did not generate enough response to justify larger mailings. For instance, a list of school music teachers did surprisingly poorly. Two lists did noticeably better, and we went ahead with larger mailings to them. One was the Percussive Arts Society membership list (percussionists are always great people). The other was the mailing list of Lark in the Morning, a fine music store specializing in rare and unusual instruments, which sells throughout the U.S. Many of you who have joined us in the last year or so may recognize yourself in one or the other of these lists.

Our mailing to Lark in the Morning people will soon be completed; when it is, we will cease our promotional mailings and return to word of mouth as our primary means for reaching new people. The recent jump in postage rates hit bulk mail rates for a much larger percentage increase than rates for other postal services, and I suspect that most people within the reach of the U.S. Postal Service feel that this is just as well. But in the meantime, our brief foray into mail order marketing did help enlarge our community of subscribers, and we are thankful for that.

I'll close our third anniversary editorial with the invitation that I find myself making every year at this time: Remember that EMI thrives upon contributions and comments from its community. We welcome article submissions (a query first is a good idea). Letters to the editor, which are at the same time letters to the readership in general, keep us on our toes and make for a better publication all around, as do your thoughts regarding topics we should cover, publications or recordings to review, ways in which we can improve and so forth. Subscribers can place ads or other blurbs in the notices column free of charge for up to forty words (write for more complete advertising information).

Thanks for joining us for another year. We will continue to do all we can to bring you the best possible publication.

NOTICES

The Dairy Barn Southeastern Ohio Cultural Arts Center will present The Music Makers, an exhibition of musical instruments by contemporary makers from around the world, Sept. 17 - Oct. 16, 1988. Instrument makers are invited to submit their work for consideration. For information contact Mark Burhans, Exhibit Coordinator, The Dairy Barn Southeastern Cultural Arts Center, Athens, OH 45701; (614) 592-4981.

The Archives of the American Gamelan Institute is publishing its first distribution catalog. The catalog lists tapes, scores, videos & monographs available through AGI. For a copy write American Gamelan Institute, Box 9911, Oakland, CA, 94613.

CASSETTE TAPES FROM EMI: From the Pages of Experimental Musical Instruments Volumes I, II, and now -- III! -- are available from EMI at $6 apiece for subscribers, $8.50 for non-subscribers. Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, beautiful, funny and lively music. Order from EMI, PO Box 784, Nicasio, CA, 94946.

Leonardo, international journal of art and technology, is launching a new electronic bulletin board called F.A.S.T., or Fine Art, Science and Technology Bulletin Board, accessible over the MCI network as well as TYMNET. It will allow rapid access to information on all applications of contemporary science and technology to the arts, plus calendars of events, job listings, freeware listings & a discussion board. For information & subscription rates write I.S.A.S.T., Secretariat, Suite 400, 8000 Westpark Dr., McLean, VA 22102, USA.

"THE BUG" -- A Portable Electroacoustic Percussion Board. You can have a whole percussion orchestra at your fingertips in the space of only two square feet! The Bug, with its assortment of rods, nails, combs, springs and strings, will delight your ear and amaze your friends and fellow musicians. Almost any contact mic and amplification system may be used. The price for direct orders is $200 plus shipping. To order, write Tom Nunn, 3016 25th St., San Francisco, CA 94110, or call (415) 282-1562.

STRING INSTRUMENT MAKERS' MEETING: The Guild of American Luthiers 11th National Convention / Exhibition will be held June 16-19 1988 at the University of South Dakota in Vermillion, hosted by the Shrine to Music Museum. The convention will feature lectures, demonstrations, & exhibition of handmade instruments. Lectures include: baroque, classic & steel string guitar repair; strings; research techniques; and tropical hardwoods. Write for registration form. Guild of American Luthiers, 8222 South Park, Tacoma, WA 98408 (206) 472-7853.

The Music Notation Modernization Association will hold its first world conference August 16-19 at the University of East Anglia, Norwich, England. For more information contact Ron Watson, 5 Meadowrise Close, Norwich NR2 3QQ, Great Britain.

The First International Symposium on Electronic Art will take place in several Dutch cities Sept. 24 - Oct. 1, 1988. Topics will include electronic & computer music, computer graphics & animation, video art, etc. For information write FISEA/SCCA, PO Box 23330, 3001 KJ Rotterdam, the Netherlands.

The Sonic Arts Gallery Spring Concert Series will have presented three concerts by the time this goes to press, with two more to go in the series. The two remaining are: Jim French, performer and maker of extraordinary new wind instruments, on June 4; and Richard Lawrence, a sound healer who works with Tibetan bells and bowls, horns and gongs, on June 10. Admission is $8; concerts start at 8:00 pm at the Sonic Arts Gallery, 612 F St., San Diego, CA 92101; (619) 237-9982.

From the Music for Homemade Instruments Spring Calendar, two events: MFHI Mystery Performance, keeping the tradition of performances at the Bowery alive, June 3, 7:57 pm, 262 the Bowery in New York City, admission $5. Summer Solstice Celebration, concert by members of MFHI at Cathedral of St. John the Divine in New York, June 11 at 2:00 pm. For more information call MFHI at (212) 226-1558.

Jonathan Glasier appears in the continuing New Instruments/New Music Series on Sunday July 3rd, 2:00 pm at 3016 25th St., San Francisco, CA. Jonathan is a composer and publisher of Interval Magazine.

A Noise in Your Eye: An International Exhibition of Sound Sculpture, catalog for the exhibit of the same name which showed in several locations in Britain in 1985 and 86, is available for L2.75 from Arnolfini, Narrow Quay, Bristol BS1 4QA, England. 60 pages long, with photos and descriptions, and introductory essay by Hugh Davies.

(Recent Articles, continued from page 20)

an interview conducted by Lona Foote. Noted avant-garde performer Fast Forward talks about his recent work with steel drums, flexible metal strips and other, mostly metallic sound sources.

SKIP LA PLANTE: MUSIC FOR HOMEMADE INSTRUMENTS, by Iris Brooks, is a report on the philosophy and recent activities of the Music for Homemade Instruments group. Some of the article is paraphrased from Skip's manuscript printed in full in this issue of EMI.

PORTFOLIO: PATRICK ZENTS by Linda Burnham, in High Performance #40, 1987 (240 S. Broadway, 5th floor, Los Angeles, CA 90012).

Described here are several of Zentz's recent environmental sound sculptures, which strive to give voice to facets of the natural environment and the passage of time. Briefly noted are some aolean flutes, a dulcimer operated mechanically by the movement of a flowing creek, a wind-operated drum, and several others.

Two of the more adventurous music stores in the U.S. have come up with new instruments catalogs. Both contain a lot of information above and beyond the requisite sales material, and both make interesting reading. They are The Lark's March, semi-annual newsletter of Lark in the Morning (PO Box 1176, Mendocino, CA, 95460) and Elderly Instruments: Acoustic Instruments and Accessories (1100 N Washington, PO Box 1420, Lansing, MI 48901).

An article in The New York Times some weeks ago reported on recent archeological scholarship on pre-Columbian flutes. The original article never found its way to EMI's headquarters, but here is how our local paper, the San Francisco Chronical, represented it:

Complex Notes From a Whistle

FOR A LONG TIME, historians and archaeologists have dismissed the lowly, tinny whistle as the toy that it appeared to be — an artifact demonstrating some culture's lighter, more frivolous, side.

But now the New York Times reports that experts are teasing thousand-year-old secrets from clay whistles, flutes and ocarinas of the ancient Americas. These wind instruments are seen as vital to the life of the Mayans and Incas, particularly the ruling elites. And because of their role in ritual, they shed light on the inner lives of the long-forgotten humans who used them.

Besides, some of the instruments have proven to be extraordinarily complex producers of subtle sounds. It is somehow satisfying to find history unlocked by the piping notes produced from a clay whistle.

RECENT ARTICLES IN OTHER PERIODICALS

Listed below are selected articles relating to unusual musical instruments which have appeared recently in other publications.

HARVESTING AMERICAN TONEWOODS by Casey Wood, and VANISHING BOW WOOD by Beverly Manasse Lee, in **Strings** Vol. II #4, Spring 1988 (PO Box 767, San Anselmo, CA 94960).

These two articles discuss hardwoods for classical string instruments. The first is about harvesting American maple and spruce; the second is about increasingly scarce pernambuco wood from Brazil, used in bow making little else.

MARRIANNE DAVIES, THE GLASS HARMONICA AND NERVE DERANGEMENT by Kenneth R. Piotrowski, in **Glass Music International, Inc. Journal**, 1988 (2503 Logan Dr., Loveland, CO 80538).

This historical essay discusses the Franklin glass harmonica, some of the leading performers of its heyday, and the peculiar notion that playing the instrument led to insanity.

Also to be found in this inaugural issue of Glass Music International's **Journal** is a revised version of the article which appeared earlier in EMI on Gerhard Finkenbeiner's glass harmonica, as well as several scores.

HEAVY METAL MADE TO ORDER by Michael McFall, in **Rhythm** Volume 1 #1, May 1988 (22024 Lassen Blvd., Suite 118, Chatsworth, CA 91311).

This short piece with several photographs describes cowbells, scrapers and more exotic metal percussion instruments built by Peter Engelhart.

CONCERT PROGRAM NOTES by Charles Amerkhanian, Bernie Krause, Jerome Neff, Wendy Reid and Jill Neff, in **Nature Sounds Society Newsletter**, Spring 1988 (Oakland Museum, Natural Sciences Division, 1000 Oak St., Oakland, CA 94607).

These are the program notes for a concert of music employing nature sounds, with notes by the composers. Birds, fish, frogs, water and weather sounds appeared in the pieces.

THE ICELANDIC LANGSPIL by Betsy Salt, in **Dulcimer Players News** Vol. 14 #2, Spring 1988 (PO Box 2164, Winchester, VA 22601).

This short article gives some history and other information on the fretted zither from Iceland.

LISTENING TO A DIFFERENT DRUMMER by Rich O'Donnell, in **Percussive Notes** Vol. 26 #3 (PO Box 697, Urbana, IL 61801).

This article, nominally part of a feature on electronic percussion, initially focusses on the way that building and working with a percussionist's diverse assortment of acoustic instruments helps cultivate an unusually refined degree of timbral awareness. It goes on to talk about applying that awareness to synthetic electronic manipulation of tone color.

SOURCES OF INFORMATION ON WOODWIND MULTIPHONICS by Antonio G. Barata, in **Perspectives of New Music** Vol. 26 #1, Winter 1988 (School of Music DN-10, University of Washington, Seattle, WA 98105).

An eight page listing of writings on woodwind multiphonics.

ARTICLES ABOUT MUSICAL INSTRUMENTS by Carolyn Bryant, in **Newsletter of the American Musical Instrument Society** Vol. XVII #1, February 1988 ((c/o Shrine to Music Museum, 414 E. Clark St., Vermillion, ND 57069-2390).

A listing of articles on instruments printed in 1985-86, culled from 40 relevant journals.

Also in the same issue of AMIS newsletter: HISTORIC HARPS SPARK INTEREST, reviewing a symposium of the Historic Harp Society, and MAJOR DOUBLE-REED EXHIBITION IN AUGUST, with information on some of the instruments to be exhibited at the International Double Reed Society meeting in Victoria, BC.

TUNING AIR RESONANCE by W.D. Allen, in **American Lutherie** #13, Spring 1988 (8222 S Park Ave., Tacoma, WA, 98408).

W.D. Allen's talks and articles appearing in American Lutherie are always clear, informative and interesting. This one discusses the role of air resonances in the sound of string instruments with enclosed soundboxes. Don't miss the hula dancing molecules' demonstration of wave motion.

HISTORICAL LUTE CONSTRUCTION: THE ERLANGEN LECTURES, DAY TWO by Robert Lundberg, also in **American Lutherie** #13.

Master Luthier Robert Lundberg discusses the construction of the body of the Rennaissance lute in this second of a series. Following the article are plans for two Lutes from around 1700.

IS YOUR WOOD READY TO USE? by George Manno, also in **American Lutherie** #13.

Mr. Manno discusses the seasoning of instrument woods, and the fact that wood sold as already seasoned may not dependably be so.

Ear Magazine Vol. 13 #1, March 1988 (325 Spring St. Rm. 208, New York, NY 10013) has several articles relating to instruments:

ELLEN FULLMAN, by Leigh Silverman, briefly describes Ellen Fullman's extraordinary, longitudinally-vibrating Long String Instrument (described more fully in EMI Vol. I #2).

IT'S 1988 -- DO YOU KNOW WHERE YOUR ANCESTORS ARE?, by Charles S. Russell, is an informative and entertainingly-written brief history of early electronic instruments, touching on many of the colorful oddities that make contemporary keyboards (be they alpha-numeric or musical) seem blah by comparison.

MARTHA WRIGHT: MUSIC IN A POTTER'S HANDS, by Mara Jayne Miller, reports on a visit with Martha Wright, a potter who is making a set of globular ceramic idiophonic drums for John Cage.

FAST FORWARD: FROM DIGITAL TO BEATEN OIL CAN is

(continued on page 19)